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ABSTRACT

Parasitological survey of 31 Bolivian cebid primates belonging to 5 genera and 6 species was carried out. The primates collected were 3 *Callicebus moloch,* 5 *Aotus azarae,* 7 *Saimiri boliviensis,* 6 *Cebus apella, 8 Alouatta seniculus* and 2 *A. caraya*. Of the 31 animals, 29 harbored one or more species of helminth parasites. New host records noted in this paper are as follows: *Callicebus moloch* for *Trypanoxyuris* (*T.*) sp. (Nematoda: Oxyuridae), *Aotus azarae* for *Phaneropsolus orbicularis* (Trematoda: Lecithodendriidae), *Cebus apella* for *Molineus elegans* (Nematoda: Trichostrongylidae), *Alouatta seniculus* for *Strongyloides cebus* (Nematoda: Strongyloididae).

INTRODUCTION

Records for helminth parasites of New World monkeys were compiled from various literatures by HERSHKOVITZ (1977). He listed 72 nematodes, 13 trematodes, 18 cestodes, 4 acanthocephalids and 2 pentastomid species found in 35 primate species. ISEKI *et al.* (1985) carried out a parasitological investigation on 19 Bolivian monkeys mainly from the state of Pand, northwestern Bolivia. They reported more than 20 species of helminths from 9 species of cebid and callitrichid monkeys, and noted new host records.

In 1986, we carried out a parasitological investigation on 31 Bolivian cebid monkeys in the states of Santa Cruz, and Beni, in western and northern Bolivia, respectively. This paper presents the incidence of the helminth parasites in these cebid monkeys.

MATERIAL AND METHODS

Thirty-one primates belonging to 6 species and 5 genera comprising of 3 *Callicebus moloch,* 5 *Aotus azarae,* 7 *Saimiri boliviensis,* 6 *Cebus apella,* 8 *Alouatta seniculus* and 2 *A. caraya,* were captured at 5 localities in Bolivia from August to October, 1986. The species, sex and localities of the capture of the individual animals are presented in Table 1 and Figure 1. When the primates were necropsied, the surfaces of the visceral organs were observed for parasites and then fixed in 10% formalin solution at the site of capture. Filarial adult worms were preserved in 10% salined formalin. The fixed materials were brought back to the laboratory, and examined.

Helminths were processed by routine methods for morphological examination.

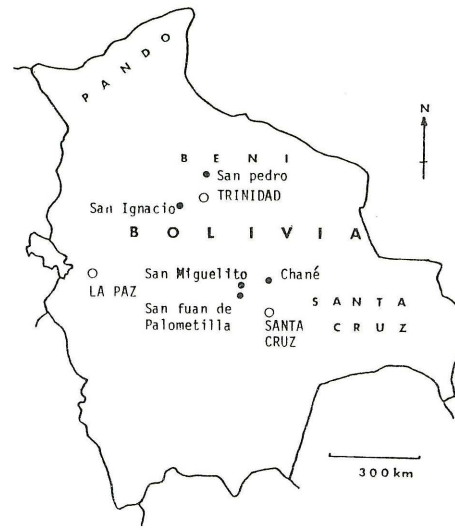

Figure 1. Map of Bolivia. Closed circles show locations where this survey was conducted

Table 1. Species, sex and localities of capture of the 31 Bolivian Primates

Individual No.	Species	Sex	Locality
1	*Callicebus moloch*	♀	San Ignacio, Beni
2	*C. moloch*	♂	San Miguelito, Santa Cruz
3	*C. moloch*	♀	San Miguelito, Santa Cruz
4	*Aotus azarae*	♂	Sun fuan de Palometilla, Santa Cruz
5	*A. azarae*	♂	Sun fuan de Palometilla, Santa Cruz
6	*A. azarae*	♀	Sun fuan de Palometilla, Santa Cruz
7	*A. azarae*	♂	Sun fuan de Palometilla, Santa Cruz
8	*A. azarae*	♂	Sun fuan de Palometilla, Santa Cruz
9	*Saimiri boliviensis*	♀	Chané, Santa Cruz
10	*S. boliviensis*	♂	Chané, Santa Cruz
11	*S. boliviensis*	♂	Chané, Santa Cruz
12	*S. boliviensis*	♂	Chané, Santa Cruz
13	*S. boliviensis*	♂	Chané, Santa Cruz
14	*S. boliviensis*	♀	Chané, Santa Cruz
15	*S. boliviensis*	♀	Chané, Santa Cruz
16	*Cebus apella*	♂	Chané, Santa Curz
17	*C. apella*	♀	Chané, Santa Cruz
18	*C. apella*	♀	Chané, Santa Cruz
19	*C. apella*	♀	Chané, Santa Cruz
20	*C. apella*	♀	Chané, Santa Cruz
21	*C. apella*	♂	Chané, Santa Cruz
22	*Alouatta seniculus*	♀	Chané, Santa Cruz
23	*A. seniculus*	♀	Chané, Santa Cruz
24	*A. seniculus*	♀	Chané, Santa Cruz
25	*A. seniculus*	♂	Chané, Santa Cruz
26	*A. seniculus*	♂	Chané, Santa Cruz
27	*A. seniculus*	♂	Chané, Santa Cruz
28	*A. seniculus*	♂	Chané, Santa Cruz
29	*A. seniculus*	♂	San Ignacio, Beni
30	*A. caraya*	♀	San Pedro, Beni
31	*A. caraya*	♂	San Pedro, Beni

RESULT AND DISCUSSION

The collected helminths are listed in Table 2, 3, and 4.

Strongyloides cebus was found in 1 of the 7 *Saimiri boliviensis* and 2 of the 8 *Alouatta seniculus. A. seniculus* may be added as a new host for this parasite.

Two *Molineus* species were found: *M. elegans* in all of the *S. boliviensis* and 4 of the 6 *Cebus apella; M. torulosus* in all of the *C. apella. M. torulosus* was found in the tumor of small intestine as reported by ISEKI *et al.* (1985).

Longistriata dubia was found in all of the 3 *Callicebus moloch. Filariopsis arator* was found in the lung of 5 *C. apella.*

Pinworms were found in all of the *C. moloch,* all of the *A. azarae,* 2 *S. boliviensis,* 4 *C. apella,* 4 *A. seniculus* and 1 *A. caraya. Trypanoxyuris* (*T.*) *interlabiata* from *A. azarae,* and *T.*

Table 2. Incidence of Helminth in the 31 Bolivian Primates

Individual No.	Species	Sp. of parasites	NEMATODA	*Strongyloides cebus*	*Molineus elegans*	*M. torulosus*	*Longistriata dubia*	*Filariopsis arator*	*Trypanoxyuris interlabiata*	*T. minutus*	*Trypanoxyuris* sp.	Pinworm (unidentified)	*Physaloptera* sp.	*Dipetalonema gracile*	Unidentified larva	TREMATODA	*Phaneropsolus orbicularis*	CESTODA	*Bertiella mucronata*	*Atriotaenia* sp.	Unidentified	ACANTHOCEPHALA	*Prosthenorchis elegans*	PENTASTOMIDA	*Porocephalus* sp.
1	*Callicebus moloch*			·	·	·	●	·	·	·	●	·	·	·	·		·		●	·	·		·		·
2	*C. moloch*			·	·	·	●	·	·	·	●	·	·	·	·		·		·	·	·		●		●
3	*C. moloch*			·	·	·	●	·	·	·	●	·	·	·	·		·		·	·	·		·		·
4	*Aotus azarae*			·	·	·	·	·	●	·	·	·	·	·	·		●		·	·	·		●		·
5	*A. azarae*			·	·	·	·	·	●	·	·	·	·	·	·		●		·	·	·		●		·
6	*A. azarae*			·	·	·	·	·	●	·	·	·	·	·	·		·		·	·	·		●		·
7	*A. azarae*			·	·	·	·	·	●	·	·	·	·	·	·		·		·	·	·		●		·
8	*A. azarae*			·	·	·	·	·	●	·	·	·	·	·	·		●		·	·	·		·		·
9	*Saimiri boliviensis*			·	●	·	·	·	·	·	·	·	·	●	·		·		·	·	·		●		·
10	*S. boliviensis*			●	●	·	·	·	·	·	·	·	·	●	·		·		·	·	·		●		●
11	*S. boliviensis*			·	●	·	·	·	·	·	·	·	·	●	·		·		·	·	·		●		·
12	*S. boliviensis*			·	●	·	·	·	·	·	·	·	·	·	·		·		·	·	●		●		·
13	*S. boliviensis*			·	●	·	·	·	·	·	·	●	·	·	·		·		·	·	●		●		·
14	*S. boliviensis*			·	●	·	·	·	·	·	·	·	·	●	·		·		·	·	·		●		·
15	*S. boliviensis*			·	●	·	·	·	·	·	·	●	·	·	·		·		·	·	·		●		·
16	*Cebus apella*			·	·	●	·	●	·	·	·	●	·	·	·		·		·	·	●		·		·
17	*C. apella*			·	●	●	·	●	·	·	·	·	·	●	·	●	·		·	·	●		●		·
18	*C. apella*			●	●	●	·	·	·	·	·	·	·	●	·	●	·		·	●	·		●		·
19	*C. apella*			·	●	●	·	●	·	·	·	●	·	●	·	●	·		·	·	·		·		·
20	*C. apella*			·	●	●	·	●	·	·	·	●	·	●	·	●	·		·	·	●		·		·
21	*C. apella*			·	·	●	·	●	·	·	·	●	·	●	·	·	·		·	·	·		●		·
22	*Alouatta seniculus*			·	·	·	·	·	·	·	·	·	·	·	·		·		·	·	·		·		·
23	*A. seniculus*			●	·	·	·	·	·	●	·	·	·	·	·		·		·	·	·		·		·
24	*A. seniculus*			·	·	·	·	·	·	●	·	·	·	·	·		·		·	·	·		·		·
25	*A. seniculus*			·	·	·	·	·	·	·	·	·	·	·	·		·		·	·	·		·		·
26	*A. seniculus*			●	·	·	·	·	·	·	·	·	·	·	·		·		·	·	·		·		·
27	*A. seniculus*			·	·	·	·	·	·	●	·	·	·	·	·		·		·	·	·		·		·
28	*A. seniculus*			·	·	·	·	·	·	●	·	·	·	·	·		·		·	·	·		·		·
29	*A. seniculus*			·	·	·	·	·	·	●	·	·	·	·	·		·		·	·	·		·		·
30	*A. caraya*			·	·	·	·	·	·	·	·	·	·	·	·		·		●	·	·		·		·
31	*A. caraya*			·	·	·	·	·	·	●	·	·	·	·	·		·		●	·	·		·		·

● Positive for the parasite

Table 3. Nematodes detected from the 31 Bolivian Primates.

Parasite		Host	Habitat
Strongyloides cebus	Strongyloidedae	*Saimiri boliviensis*, *Alouatta seniculus**	Small instestine
Molineus elegans	Trichostrongylidae	*Saimiri boliviensis*, *Cebus apella**	Small intestine
Molineus torulosus	Trichostrongylidae	*Cebus apella*	Small intestine
Longistriata dubia	Heligmosomatidae	*Cellicebus moloch*	Small intestine
Filariopsis arator	Filaroididae	*Cebus apella*	Lung
Trypanoxyuris interlabiata	Oxyuridae	*Aotus azarae*	Caecum, colon
Trypanoxyuris minutus	Oxyuridae	*Alouatta seniculus*, *Alouatta caraya*	Caecum, colon
Trypanoxyuris sp.	Oxyuridae	*Callicebus moloch**	Caecum, colon
Pinworm (Unidentified)	Oxyuridae	*Saimiri boliviensis*, *Cebus apella*	Caecum, colon
Pyhsaloptera sp.	Physalopteridae	*Cebus apella*	Stomach
Dipetalonema gracile	Dipetalonematidae	*Saimiri boliviensis*, *Cebus apella*	Peritoneal cavity
Unidentified	(Larval stage)	*Cebus apella*	Liver

*New host species described

Table 4. Trematodes, Cestodes, Acanthocephalid and Pentastomid from the 31 Bolivian Primates

Parasite		Host	Habitat
Phaneropsolus obricularis	Trematoda; Lecithodendriidae	*Aotus azarae**	Small intestine
Bertiella mucronata	Cestoda; Anoplocephalidae	*Callcebus moloch*, *Alouatta caraya*	Small intestine
Atriotaenia sp.	Cestoda; Anoplocephalidae	*Cebus apella*	Small intestine
Unidentified	Cestoda;	*Saimiri boliviensis*, *Cebus apella*	Small intestine
Prosthenorchis elegans	Acanthocephala; Oligacatho-rhynchidae	*Callicebus moloch*, *Aotus azarae*, *Saimiri boliviensis*, *Cebus apella*	Ileo-caecal junction
Porocephalus sp.	Pentastomida; Porocephalidae	*Cellicebus moloch*, *Saimiri boliviensis*	Tissue cyst (Liver, stomach, mesentry)

*New host species described.

(*T.*) *minutus* from *A. seniculus* and *A. caraya* were identified according to the criteria proposed by SKRJABIN *et al.* (1960) and INGLIS (1961). The finding of *Trypanoxyuris* (*T.*) sp. from *C. moloch* may be the first host record for the oxyurid. Although this worm has morphological characters of the genus *Trypanoxyuris* , it is easily distinguished from known species by its head structure. The details of its morphological character will be reported in the near future. ISEKI *et al.* (1985) also reported unidentified female pinworm from *C. moloch.* The species of other pinworms from *S. boliviensis* and *C. apella* could not be identified because only female specimens were collected.

Physaloptera sp. was found in 5 *C. apella.* HERSHKOVITZ (1977) listed 2 species of *Physaloptera; P. cebi* and *P. dilatata.* The female worm of *P. cebi* has three uteri, and so can be distinguished from that of *P. dilatata.* The present specimen has three uteri, however specific identification could not be made because of the lack of the description of *P. cebi.*

Dipetalonema gracile was found in 4 *S. boliviensis* and 2 *C. apella.* All the worms were found in the abdominal cavity.

Four *C. apella* were infected with nematode larvae which parasitize on the surface of the liver. These larvae could not be identified.

Phaneropsolus orbicularis (Trematoda) was found in 3 *A. azarae* and this presents a new host record.

Nine of the 31 primates were infected with cestodes. *Bertiella mucronata* was found in 1 *C. moloch* and 2 *A. caraya, Atriotaenia* sp. in 1 *C. apella.* The species of other cestodes collected from 2 *S. boliviensis* and 3 *C. apella* could not be identified due to incompleteness of the specimen.

Proshenorchis elegans (Acanthocephala) was found in 1 *C. moloch,* 4 *A. azarae,* all of the *S. boliviensis* and 3 *C. apella.*

Nymphs of *Porocephalus* sp. (Pentastomida) were found in 1 *C. moloch* and *S. boliviensis.*

There are many reports on the ecological and phylogenic relationships between parasites and hosts. CAMERON (1929) stated that the phylogeny of the pinworm parallels that of the host, and that in the primates, each oxyurid species is restricted to parasitizing only the host of one genus. With regard to the New World primates, INGLIS (1961) after studying the helminths of Venezuelan monkeys caught from the wild, suggested the validity of the "CAMERON Hypothesis". In the present study, the detection of 3 species of pinworms belonging to the genus *Trypanoxyuris* in 3 different primates host species supported that "hypothesis".

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